

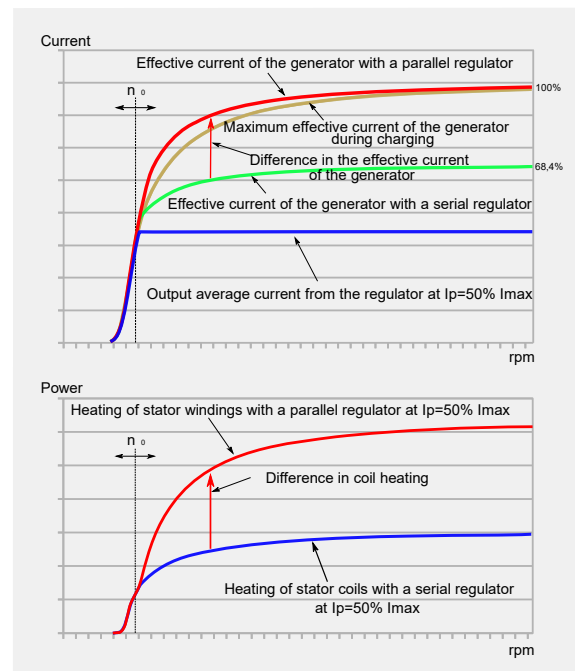
Theoretical comparison of the use of parallel and serial regulators

Often, the question arises about the advantage of a serial thyristor-diode rectifier compared to a classical factory regulator. It is clear that the serial regulator reduces the generator current because it does not have the short-circuit current produced by the parallel regulator.

Specifically, we can show how the generator current and stator coil heating depend on the given consumption of 50% of the maximum current for a single-phase charging regulator.

In the upper diagram, the specified output average current is shown (blue). The serial regulator produces an effective current in the generator (green). The effective current of the generator and the output average current differ in value. Since the possible current from the generator for charging (olive) exceeds the consumption current, it flows in periodic pulses, and its effective value increases as the current becomes stronger (although the pulse width is smaller). This affects the heating of the stator coils. It is possible that using a measuring instrument that does not calculate the effective value may show data similar to the output average current.

In the lower diagram, the heating of the coils can be seen. Blue is the serial regulator. According to the diagram, it can be seen that when the serial regulator starts to pulse-rectify to maintain the required output average current, it then has a beneficial effect on the coils and limits the heating to half for the specific consumption current.



In contrast to the serial regulator, the parallel regulator in this case (output average current is 50% of the maximum charging current) even increases the generator current to a higher value than the generator provides during charging (as the red curve is higher than the olive one). This is a result of creating a short circuit of the generator when the generator provides more current than needed. In a short circuit, the current from the generator increases because the closing voltage is lower than during charging. This is most visible when the generator voltage is lower, and the effect of the low closing voltage has a greater impact. At high generator voltages, the generator current during charging and short circuit almost match. In the lower diagram of coil heating, it can be seen that the parallel regulator (with 50% specified consumption) doubles the heating of the coils.

It is expected that the consumption from the generator must be limited to around 50 to 60% of the generator's maximum power to enable the accumulator to be charged in an average number of revolutions. This makes these diagrams applicable for real comparison. When generating the diagrams, the coil resistance, expected rectifier voltage, and short-circuit voltage were taken into account. The vertical mark n_0 represents the place of the gas lever. It is possible that some generators cannot provide 50% of the output current at the gas lever, while others can.

Conclusion: The use of a serial regulator has a beneficial effect on reducing the heating of the generator coils. In this representation, by about 50%. The effective current in the generator is reduced by about 30% (from the red vertical arrow to higher revolutions). The reduction in consumption has a beneficial effect on the motor, allowing it to accelerate faster and consume less fuel. Less heating of the generator coils reduces the risk of overheating, thus increasing the lifespan. The reduction in effective current also affects the reduced heating of the connectors and wires of the generator towards the regulator and the reduced heating of the regulator itself.

An additional conclusion that can be seen from the diagrams is that a high number of motor revolutions allows high effective currents and that it is then most likely to cause coil or regulator failure. The serial regulator, unlike the parallel one, heats less (since a smaller effective current flows through it) and can completely stop working in case of overheating (if it has a thermal sensor - all serial SPER regulators have it), while the generator coil is much less loaded.